

## **Operating Instructions**

- 33575 Receiver GR-12 SH +3xG HoTT
- 33576 Receiver GR-12 +3xG HoTT
- 33577 Receiver GR-12 +3xG+3A Vario



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## MANY THANKS

for deciding to purchase the Graupner/SJ HoTT 2.4 system. Please read right through these operating instructions before you attempt to install and operate the Graupner HoTT 2.4 system.

- The receiver stabilises the model aircraft in difficult, windy conditions, acting on a maximum of three axes
- Proportional gyro suppression for natural flying characteristics
- Excellent stabilisation for smooth, accurate manoeuvres
- The triple-axis gyro endows even very demanding aerobatic models with docile flying characteristics, and greatly simplifies aerobatics
- Aerobatic manoeuvres can be flown much more accurately
- Simple gyro assignment procedure
- Facility to adjust parameters using HoTT telemetry
- Altitude sensor for vario and altimeter function (Order No. 33577)

## 1. APPROVED USAGE

The receiver is intended exclusively for use in radio-controlled models. Any other usage is prohibited, and may result in damage to the receiver or model, and serious personal injury. We grant no guarantee and accept no liability for any type of use outside the stipulated range. Not suitable for children under fourteen years. This receiver is not a toy!

The receiver is also equipped with a telemetry function which is only available in combination with a Graupner/SJ HoTT 2.4 system. If you do not own a Graupner/SJ HoTT 2.4 system, the receiver will not work.

Please start by reading through the whole instructions before you attempt to install and operate the receiver.

These operating instructions are an integral part of the product. They contain important notes on operating and handling the receiver. For this reason please store the operating instructions in a safe place, and pass them on to the new owner if you ever dispose of the product. Failure to observe the operating instructions and safety notes invalidates the guarantee.



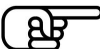
Here at Graupner we are constantly working on the further development of all our products; for this reason we are obliged to reserve the right to introduce changes to the set contents in form, technology and features.

Please understand that we will not countenance claims resulting from information and illustrations in these operating instructions.















*Please store the operating instructions in a safe place for future reference!*

## 1.1 SAFETY NOTES

### KEY TO THE SYMBOLS

	<b>Caution!</b> This symbol alerts you to prohibited actions which must be observed at all times. Any failure to observe the prohibited action indicated in this way may prevent the equipment working, and endanger the safety of the operator.
	<b>Caution!</b> This symbol alerts you to information which must be observed at all times. Any failure to observe the information indicated in this way may prevent the equipment working properly, and endanger the safety of the operator.
	This symbol indicates information which should always be observed in order to ensure that the equipment operates reliably.

## SAFETY NOTES

	<b>Warning!</b> The receiver must never be operated under the influence of medication, alcohol, drugs etc.
	<b>Caution!</b> Any deviation from the instructions may have an adverse effect on the function and operational security of the receiver, and must be avoided under all circumstances.
	<b>Caution!</b> The operator bears full responsibility for using the receiver. The only way to guard against personal injury and property damage is to handle the equipment carefully and use it exactly as recommended.
	<b>Caution!</b> Not suitable for children under fourteen years.
	<b>Caution!</b> Protect the receiver from dust, soiling, damp and foreign bodies. Never subject the receiver to excessive vibration, heat or cold.
	<b>Caution!</b> During the programming process you must bear in mind that an internal combustion engine or electric motor could unexpectedly burst into life at any time.
	<b>Caution!</b> Avoid subjecting the receiver to shocks and pressure. Check the receiver regularly for damage to the case and cables. Do not re-use a receiver which is damaged or has become wet, even after it has dried out again.
	<b>Caution!</b> When deploying the cables ensure that they are not under tension, not tightly bent (kinked) or fractured. Avoid sharp edges which could damage cable insulation.
	<b>Caution!</b> Ensure that all plug-in connections are firmly seated. Do not pull on the wires when disconnecting plugs and sockets.
	<b>Caution!</b> The receiver must not make physical contact with the model's fuselage, hull or chassis, as this would allow motor vibration and landing shocks to be transferred directly to it.
	<b>Caution!</b> It is not permissible to carry out modifications of any kind to the receiver. Any changes invalidate product approval, and you forfeit any insurance protection.
	<b>Caution!</b> Ensure that the equipment is working correctly and at full range before every flight. Check the state of the batteries at regular intervals.
	<b>Note!</b> Ensure that all your HoTT components are loaded with the current version of the software at all times.
	<b>Note!</b> Safety is no accident, and radio-controlled models are not playthings!

## 1.2 GENERAL NOTES

- The receiver's integral gyros are very fast, high-resolution components. This means that you should always use high-speed digital servos wherever possible, so that the gyro's corrective signals are converted directly and accurately into servo movement; this helps to prevent the model oscillating.
- Keep all servo extension leads as short as possible.
- When switching on or adjusting the radio control system, it is essential to keep the transmitter aerial at least 15 cm from the receiver aerial(s). If the transmitter aerial is too close to the receiver aerials, the receiver will be swamped and the red LED on the receiver will light up. The transmitter responds with a flashing red LED and repeated beeps at approximately one-second intervals, i.e. the radio control system reverts to fail-safe mode. If this should happen, increase the distance until the audible warning ceases, and the blue transmitter LED lights up constantly once more. The red LED on the receiver should now be off.

## 2. FUNCTIONS

### 2.1. Binding

The Graupner/SJ HoTT 2.4 receiver must be "bound" to "its" Graupner/SJ HoTT 2.4 RF module (transmitter) before a radio link can be created between them; this process is known as "binding". Binding is only necessary once for each combination of receiver / RF module, so the binding procedure described below only needs to be repeated if you add more receivers. However, binding can be repeated at any time if you wish; for example, if you switch transmitters. This is the procedure in detail:

- Binding is only possible if the receiver has not been linked with a bound transmitter since being switched on (red LED lights); press the SET button to set the receiver to BIND mode.
- If you have already bound a receiver to the transmitter, and wish to bind the receiver to a new model memory, this is the procedure:
- Switch the transmitter's RF section off in the "Basic model settings" menu.
- Switch the receiver on, and press the SET button to set it to Bind mode.
- Initiate binding in the transmitter's "Basic model settings" menu.
- The red receiver LED should go out within about ten seconds. If it does, the binding process has been completed successfully.
- Your transmitter / receiver combination is now ready for use.
- However, if the red LED continues to glow, then the binding process has failed. If this should happen, repeat the whole procedure.

#### 2.1.1. Binding multiple receivers per model

If necessary it is also possible to bind more than one receiver to a particular model. First bind each receiver individually as described earlier.

When the system is actually in use, the receiver which was last bound acts as the Master unit, and any telemetry sensors installed in the model must be connected to this receiver, as only the Master receiver transmits the data to the ground using the downlink channel. The second - and any other - receivers operate in Slave mode, in parallel with the Master receiver, with the downlink channel switched off.

The channel mapping function of HoTT telemetry also allows the control functions to be divided up amongst multiple receivers, or alternatively the same control function to be assigned to multiple receiver outputs. For example, this is useful if you wish to actuate each aileron with two servos instead of just one.

### 2.2. Fail-Safe function

In the receiver's default state, all connected servos remain in their last valid position ("Hold" mode) if a fail-safe situation should arise. In fail-safe mode the red LED on the receiver lights up, and the transmitter generates an audible alert by beeping at a rate of around one per second.

You can exploit the safety potential of this option by at least setting the throttle position (for internal-combustion powered models) to Idle, or the motor function (electric-powered models) to "Stop", or "Hold" for a model helicopter, if a fail-safe event should occur. These settings ensure that the model is less likely to fly out of control if interference should occur, thereby helping to avoid property damage or even

personal injury.

*Read the operating instructions supplied with your radio control system for more details.*

*The gyro system remains active in a fail-safe situation.*

## 2.3 Range-checking

The range of your Graupner/SJ HoTT 2.4 system can be checked as described in the following instructions. We recommend that you ask a friend to help you with the procedure.

Ideally the receiver should already be bound to the transmitter. Install it in the model in its final position.

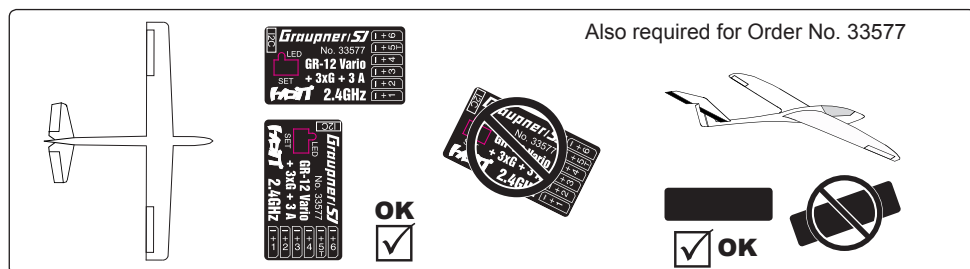
- Switch the radio control system on, and wait until the red LED on the receiver goes out. The servo movements can now be observed.
- Place the model on a flat surface (pavement, close-mown grass, earth), and ensure that the receiver aerials are at least 15 cm above the ground. It may be necessary to pack up the model to achieve this for the period of the range-check.
- Hold the transmitter away from your body at hip-level. Don't point the transmitter aerial straight at the model; instead rotate or angle the aerial tip in such a way that it is vertical when you operate the transmitter controls.
- Select range-check mode, as described in the transmitter instructions.
- Walk away from the model, moving the transmitter sticks. If you detect an interruption in the radio link at any time within a distance of about 50 m, see if you can reproduce the problem.
- If your model is fitted with a motor or engine, switch it on or start it, so that you can check effective range when potential interference is present.
- Walk further away from the model to the point where full control is no longer possible.
- At this point you should manually switch off range-check mode.

The model should now respond to the controls again. If this is not 100% the case, do not use the system. Contact the Graupner/SJ Service Centre in your locality and ask their advice.

We recommend that you carry out a range-check before every flight, simulating all the servo movements which occur in flight. To guarantee reliable model operation, radio range must always be at least 50 m on the ground.

## 2.4 INSTALLATION IN THE MODEL

The gyro-receiver must be installed "square" relative to the model, i.e. at right-angles to the aircraft's longitudinal axis, otherwise the gyros will be unable to function as intended (Order No. 33577 must also be horizontal relative to the fuselage centreline to allow the accelerometer to work correctly).



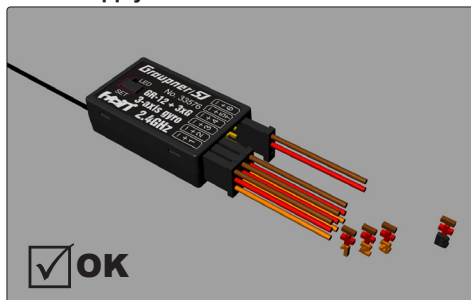
### 3. RECEIVER

#### 3.1 Connections

Connect the servos to the row of sockets on one end of the receiver. The connectors are polarised: note the small chamfers on one side. Never use force - the connectors should engage easily. The polarity is also printed on the receiver; the negative wire (-) is brown, the positive (+) red and the signal orange. The servo sockets of Graupner/SJ HoTT 2.4 receivers are numbered sequentially. The socket for channel 6 can also be programmed to deliver a (digital) sum signal (see section 3.2: Receiver set-up).

**I<sup>2</sup>C (Inter-Integrated Circuit) - socket currently not active; for servicing purposes only!**

#### Power supply





The receiver does not feature specific sockets for connecting the battery. We recommend that you connect the power supply to the socket(s) close to the servos already connected to the receiver. If you wish to connect multiple separate batteries, the batteries must be of the same nominal voltage and capacity. Never connect batteries of different type, or packs of greatly differing states of charge, as this can cause effects similar to a short-circuit. If you encounter this problem, we recommend the use of a voltage stabiliser unit (e.g. PRX-5A receiver power supply, Order No. 4136) between the batteries and the receiver.

#### Telemetry

The optional telemetry sensors are connected to the socket marked "T" (Telemetry). Alternatively the receiver can monitor a voltage up to max. 25.5 V DC via this socket, which is also used to update the receiver's firmware with the help of the USB interface.

**NOTE:** you can **either** connect this socket to a servo **or** a telemetry sensor **or** the battery to be monitored; the receiver must be set up accordingly. Please see the following section for further details.

**WARNING:** never connect a battery with a voltage higher than 8.4 V DC directly to the receiver, as this would instantly ruin the unit and any servos or other accessories connected to it.

**Caution!** If you activate voltage measurement, the receiver can monitor a voltage of up to max. 25.5 V DC via this input, but **only** if the circuit shown below is used. **Never** connect a battery to the Telemetry socket without this circuit!

A circuit diagram for voltage measurement. It shows a battery connected to a 50 mm wire, which is connected to the 'Channel 5' socket. The other end of the 50 mm wire is connected to a 100 nF capacitor. The other end of the 100 nF capacitor is connected to a 2K7 resistor. The other end of the 2K7 resistor is connected to a 22KOhm resistor. The other end of the 22KOhm resistor is connected to the 'max. 25,5 V DC' socket. The other end of the 22KOhm resistor is connected to a 100 mm wire, which is connected to the 'max. 25,5 V DC' socket. The other end of the 100 mm wire is connected to the 'max. 25,5 V DC' socket.

**PROGRAMMING THE GENERAL RECEIVER SETTINGS:**

The receiver can be programmed using a suitable HoTT transmitter or the SMART-BOX (Order No. 33700).

RECEIVER	1.0	< >
>ALARM VOLT:	3.8V	
ALARM TEMP:	70°C	
max altitude:	125m	
Period:	10ms	
SUMD at K6:	No	
K5:	SERVO	
LANGUAGE:	english	

**3.2 RECEIVER SET-UP MENU**

The receiver set-up menu appears in the “Telemetry” menu under SETTINGS / DISPLAYS; alternatively - if you are using a SMART-BOX - under SETTING & DATAVIEW. *The method of accessing this menu is described in the operating instructions supplied with your transmitter or the Smart-Box.*

Display	Explanation	Settings
RECEIVER 1.0	1.0 indicates the version of the receiver's firmware	-
ALARM VOLT.	Alarm threshold for the receiver's low voltage warning (or voltage measurement)	2.5 - 24.0 V Default setting: 3.8 V
ALARM TEMP.	Receiver overheating warning	50 - 80° C Default setting: +70° C
Max. height	Order No. 33577 only, with integral vario: maximum altitude	0 - 2500 m in 25 m increments
ZYKLUS	Cycle time (frame rate) in ms	10 / 20 ms
SUMD an K6	Digital sum signal at channel 6	Yes / No
K5	Use of channel 5: servo, telemetry sensor or voltage measurement	Servo, Sensor, Spannung Werkseinstellung: Servo
LANGUAGE	Select menu language	German, English, French, Italian or Spanish

**Low-voltage warning (ALARM VOLT):** if the receiver voltage or the external voltage connected to channel 5 falls below the set value, a low-voltage warning is generated by the transmitter's RF module in the form of the “general alarm tone”: a regular beeping at a rate of about one per second; alternatively the speech output message “Receiver voltage”.

**Temperature warning (ALARM TEMP):** if the receiver temperature exceeds the set temperature threshold, a warning is generated by the transmitter's RF module in the form of the “general alarm tone”: a regular beeping at a rate of about one per second; alternatively the speech output message “Receiver temperature”.

**Maximum height (Max. height) - Order No. 33577 with integral vario only:** at this point you can enter a maximum altitude, at which an alarm is triggered, either via the transmitter's RF module in the form of the “general alarm tone”: a regular beeping at a rate of about one per second; alternatively the speech output message “Height”. *Note:* the model's actual height is adopted as zero when the receiver is switched on; the indicated height is therefore the altitude relative to the launch point.

**Cycle time (CYCLE):** if your system is used exclusively with digital servos, you can set a cycle time (frame rate) of 10 ms at this point. If your system includes some or all analogue servos, you should always select 20 ms, as many analogue servos cannot process the higher frame rate, and may respond

by “jittering” or “growling”.

**HoTT sum signal (SUMD):** if you activate the digital sum signal at channel 6, a sum signal containing eight channels is present at this socket, instead of a servo signal. The HoTT receiver configured as SUMD constantly generates a digital sum signal from 8 control signals from the transmitter and makes this signal available at the appropriate servo socket, which is receiver-specific. At the time these instructions were revised, this type of signal is used by several of the latest electronic developments in the area of flybarless systems, heavy-duty airborne power supplies, etc.

**WARNING:** if you wish to use this facility, it is essential to observe the set-up information supplied with the devices connected to the receiver, otherwise there is a risk that your model may be uncontrollable.

**Channel 5 (Ch5):** channel output 5 can be used to control a servo, as a telemetry socket or for voltage monitoring. If you activate voltage monitoring, the receiver can measure a voltage of up to max. 25.5 V DC via this input (instead of a servo or telemetry sensor) using the circuit described in section 3.1. The monitored voltage is then displayed on the screen instead of the receiver voltage. This makes it possible, for example, to monitor the flight battery directly, without the need for an additional voltage sensor.

**If channel 5 is set to ‘sensor’ or ‘voltage’ instead of servo, the channel 5 signal is automatically available at channel 6. This change will not take effect until turning on / off the receiver.**

3.3 FREE MIXERS

RX FREE MIXER < >

>MIXER: 1


MASTER CH: 1

SLAVE CH: 6

TRIM: +0%

TRAVEL-: +100%

TRAVEL+: +100%



**Important note:** If you wish to use the gyros, you must always set the tail type to ‘normal’ in the transmitter’s model type menu. If your model is a delta, features a V-tail, or has two elevator servos, you must use the receiver mixer - not the transmitter mixer - to control these control surfaces, since the gyro stabilisation system will have no effect on these servos otherwise. The four receiver mixers work ‘downstream’ of the gyros. If you have already programmed mixer functions in the “Wing mixers” or “Free mixers” menu of your HoTT transmitter, you must ensure that those mixers do not overlap with those available in this menu!

Screen Display	Key	Settings
MIXER	Mixer select	1, 2,...4
FROM CHANNEL	Signal source / source channel	0,1,2,...6
TO CHANNEL	Target channel	0,1,2,...6
TRIM	Trim position in %	-15 - + 15%
TRAVEL-	Travel limit at % Servo travel	-150 bis +150%
TRAVEL+	Travel limit at % Servo travel	-150 bis +150%

**MIXER:** up to four mixers can be programmed simultaneously. You can switch between Mixer 1, Mixer 2, ... and mixer 4 in the “Mixer” line.

The following settings only affect the mixer selected in this line.

**FROM CHANNEL:** the signal present at the signal source (or source channel) is mixed in to the target channel (TO CHANNEL) to an extent which can be set by the user. The method of setting up the values is analogous to the “Free mixers” menu in HoTT transmitters.

**TO CHANNEL:** part of the source channel signal (FROM CHANNEL) is mixed into the target channel (TO CHANNEL). The mixer ratio is determined by the percentage values entered in the “TRAVEL-“ and “TRAVEL+” lines. Select “0” if you do not require the mixer.



**Mixer ratio (TRAVEL-/+):** in these two lines you can define the mixer ratio in relation to the source channel (FROM CHANNEL); the value is set separately for both directions.

### Programming examples:

#### V-tail with rudder differential

RX FREE MIXER	<	>	RX FREE MIXER	<	>	RX FREE MIXER	<	>
>MIXER:		1	>MISCHER:		2	>MIXER:		3
MASTER CH:		3	MASTER CH:		4	MASTER CH:		4
SLAVE CH:		4	SLAVE CH:		3	SLAVE CH:		4
TRIM:		+0%	TRIM:		+0%	TRIM:		+0%
TRAVEL-:		+100%	TRAVEL-:		-60%	TRAVEL-:		+100%
TRAVEL+:		+100%	TRAVEL+:		+100%	TRAVEL+:		+60%

Differential is not normally necessary with this tail type. Mixer 3 is not required if you do not need rudder differential, and TRAVEL- for mixer 2 must then be set to -100%.

Alternatively you may prefer to carry out the programming using the transmitter menu. A 'Rudder → elevator' mixer can be set up at the transmitter instead of 'Free mixer 3' at the receiver; the mixer should be set up asymmetrically, e.g. +30%, -30%. This option frees up one mixer at the receiver.

#### Delta with aileron differential (1 aileron)

RX FREE MIXER	<	>	RX FREE MIXER	<	>	RX FREE MIXER	<	>
>MISCHER:		1	>MISCHER:		2	>MISCHER:		3
MASTER CH:		2	MASTER CH:		3	MASTER CH:		2
SLAVE CH:		3	SLAVE CH:		2	SLAVE CH:		2
TRIM:		+0%	TRIM:		+0%	TRIM:		+0%
TRAVEL-:		+100%	TRAVEL-:		-100%	TRAVEL-:		+60%
TRAVEL+:		+60%	TRAVEL+:		-100%	TRAVEL+:		+100%

In this example aileron differential is set to 40%. Alternatively you may prefer to carry out the programming using the transmitter menu. An 'Aileron → elevator' mixer can be set up at the transmitter instead of 'Free mixer 3' at the receiver; the mixer should be set up asymmetrically, e.g. +30%, -30%. This option frees up one mixer at the receiver.

#### Two elevator servos

(channel 6 for the second elevator servo)

RX FREE MIXER	<	>
>MISCHER:		1
MASTER CH:		3
SLAVE CH:		8
TRIM:		+0%
TRAVEL-:		+100%
TRAVEL+:		+100%

### Only for transmitters without a butterfly (crow) mixer (e.g. mx-10 HoTT):

If a butterfly (crow) mixer is required, you will not be able to use one of the two functions 'differential' or 'landing flap' adjustment, as two mixers are needed for this.

#### Programming example:

RX FREE MIXER	<	>	RX FREE MIXER	<	>
>MIXER:		1	>MISCHER:		2
MASTER CH:		1	MASTER CH:		1
SLAVE CH:		2	SLAVE CH:		5
TRIM:		+0%	TRIM:		+0%
TRAVEL-:		+100%	TRAVEL-:		-100%
TRAVEL+:		+100%	TRAVEL+:		-100%

#### Programming example:

RX FREE MIXER	<	>	RX FREE MIXER	<	>
>MISCHER:		1	>MISCHER:		2
MASTER CH:		1	MASTER CH:		1
SLAVE CH:		2	SLAVE CH:		3
TRIM:		+0%	TRIM:		+0%
TRAVEL-:		+100%	TRAVEL-:		-100%
TRAVEL+:		+100%	TRAVEL+:		-100%

### 3.4 ASSIGNING THE GYRO AXES

GYRO ASSIGNMENT	<		GYRO ASSIGNMENT	<	
>AILERON SERVOS:		2	>AILERON SERVOS:		2
DO SETUP:		YES	DO SETUP:		NO
AILERON:		+2	AILERON:		+2
ELEVATOR:		+0	ELEVATOR:		+1
RUDDER:		-0	RUDDER:		-3

**Aileron servos:** you should enter the value 2 in this line if your model has two aileron servos; in this case the gyro for channel (servo) 2 also acts on servo 5. If the ailerons are also used as flaperons or speedbrakes, gyro suppression is based on the sum of both channels.

**CAUTION:** the servo reverse setting must be the same for both aileron servos, i.e. either both 'normal' or both 'reverse'. If this is not possible, **on no account** should you reverse one servo in the transmitter menu. The only option is to re-install it in the model by turning it round physically. However, if your model is fitted with programmable servos (e.g. Graupner DES, HVS or HBS types - see the instructions for the update program 'Firmware\_Upgrade\_grStudio' - then it is possible to reverse the direction of rotation at the servo itself.

Please read the installation notes on page 5 of these instructions. The first step is to define the three gyro axes and the orientation of the receiver. This is accomplished by switching on the transmitter and model, and selecting 'New setting: yes' in the receiver's 'Gyro settings' menu.

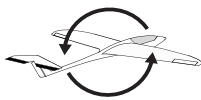

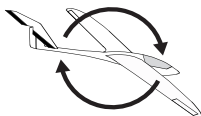
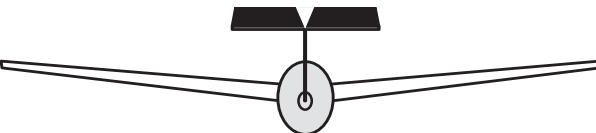
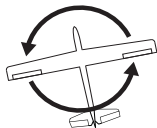
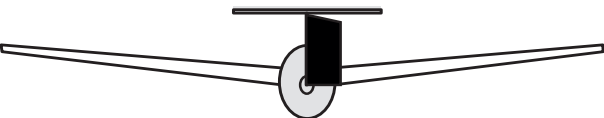
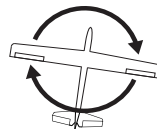
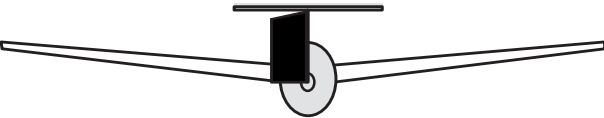
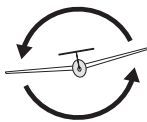
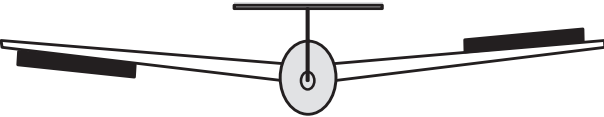
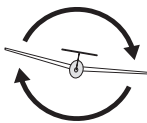
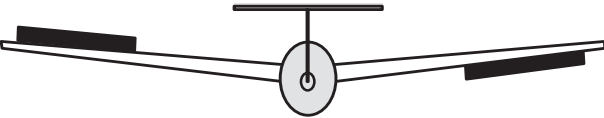
- Now move the stick for any control surface to full travel in one direction; in the following example we use the aileron channel.
- The detected axis (aileron) is highlighted (black background). (In the receiver's default state the value for all axes is shown as '+0'; the axes can also be set manually to '+0'. 0 = inaktiv)
- Now turn the model through at least 45° in the direction corresponding to the stick movement. For example, if you moved the aileron stick to the left, you must simulate a left turn with the model →

move the left wing down through at least 45°.

- This process defines the one axis and direction; now you must repeat the procedure for the other two axes.
- The gyro axis 1, 2 or 3 is now displayed in the 'Aileron / Elevator / Rudder' display; a negative prefix will appear if servo reverse is activated.
- Once all three axes are defined, the display automatically reverts to 'New setting: no'.



**WARNING:** once you have completed this procedure, it is absolutely essential to check that all the gyros are working in the correct direction. This is accomplished by moving the model around all three axes in turn, and checking the control surface deflections - see diagrams below. You must not fly the model before doing this: crash hazard!

ELEVATOR	
Model movement	Control surface response (seen from the tail)
	
	
RUDDER	
Model movement	Control surface response (seen from the tail)
	
	
AILERON	
Model movement	Control surface response (seen from the tail)
	
	

## 4. PROGRAMMING THE GYRO SETTINGS:

### PID (Proportional Integral Differential) correction

The stabilising effect of the gyro sensors is based fundamentally on three parameters:

#### ***P factor: defines proportional correction***

P = proportional: if the intended value is not the same as the actual value, then the difference is fed proportionally into the corrective signal; in simple terms, the input value (e) is multiplied by a fixed value:  $u(t) = K_p \cdot e(t)$ .  $K_p$  is termed the amplification value. The output value is therefore proportional to the gyro's input value. Proportional correction cannot occur until a deviation from the intended value is present; if the deviation is 0, then the product is also zero. If the amplification value is set too high, the P factor causes the model to oscillate and become unstable.

#### ***I factor: integral correction (not currently implemented)***

#### ***D factor: defines differential correction***

D = differential: in this case the corrective output value is affected by the rate of change of the input value, i.e. the faster the model tilts around the axis, the more pronounced the corrective response of the gyro. If the model changes attitude very gently, then the D factor causes hardly any corrective action. It also makes absolutely no difference how far the model has already changed attitude; the crucial value is only the speed or rate of the movement. The rate of change is again multiplied by a factor (as with P correction) to produce the output value. For this reason pure D correction is not used; it must always be employed in combination with P correction.

### 4.1 Programming PID correction - Gyro settings display:



**CAUTION:** before you start entering settings for a new model, it is essential to select the number of aileron servos in the **Aileron servos** menu point, and to define the gyro axes and orientation in the **New settings** menu point.

**Aileron / Elevator / Rudder:** shows the programmable P factors for the corresponding control surface.

*Note:* the gyro axes must first be defined under **New settings** (see section 3.4).

*If you wish to disable the gyro, enter the value OFF in the appropriate control function.*

#### ***P factor:***

The P factor should always be set first, followed by the D factor (adjustment range in each case 0 to 10). A general rule is that the larger the control surface, the smaller the P factor required. Start with a factor of 2 (default setting), and do not exceed 4 - 5 as maximum value for the normal flight phase, 2 - 3 for speed, 3 - 6 for landing; the maximum value of 10 should be reserved for torque-rolls only.



**WARNING:** if you program separate flight phases, it is essential to select the appropriate flight phase when the model is in the air, as inappropriate gyro settings may cause the control surfaces to oscillate, possibly resulting in the loss of the model!

**Note:** the higher the model's speed, the more quickly oscillation may set in.

**D factor:** for a given P factor setting, the model's tendency to oscillate can be reduced by setting a lower D factor. However, if you select a lower setting for the P factor, then you may be able to set a higher D factor value before the onset of control surface oscillation. The gyro effect can be optimised by fine-tuning the D factor.

*Note:* the standard P and D values should cause the gyros to correct the model's attitude quickly when it is upset by an outside influence, without causing oscillation, but in practice the optimum values for a particular model can only be found by flight-testing. If the model displays little or no automatic stabilisation with the default settings, the value should be raised; on the other hand, if the model oscillates (wave-like movements in flight), the value should be reduced.

If your transmitter has spare proportional controls, you can use them to adjust the values while the model is flying.

Some transmitters allow the corrective factors to be altered during a flight using the proportional controls, whereas others allow fixed values only.

## 4.2 Programming the factors

### 4.2.1 Programming, transmitter with proportional controls

If your HoTT transmitter is equipped with proportional controls, it is also possible to adjust the P and D factors for each axis during a flight: what you might call 'flying the settings'. You need to assign proportional controls (e.g. the sliders on the mc-20) to any channel in the range 5 to 16 (in this example channel 9); now you can alter the P factor (and the D factor) using these controls. In each case the current values are shown in brackets.

Procedure, using the ailerons as an example:

GYRO SETTINGS		< >
>AILERON:	(2)	K9
ELEVATOR:	(3)	K8
RUDDER:		6
COEFF. :	(44%)	K10
COEFF. D:	(140%)	K11

- Move the cursor to the appropriate line, in this case "Ail" for aileron.
- Press the SET button to activate the Channel field.
- Select the appropriate channel, and save the setting with pressing the SET button again
- move the corresponding proportional control to alter the factor (adjustment range 0 - 10; 0 means no gyro correction for that axis).
- You can also adopt this factor directly by pressing the left button < or the right button >. This frees up the channel previously occupied by the proportional control, so that it can be used for some other purpose, e.g. for elevator or rudder.
- Move on to elevator and / or rudder, and select the channel and factor (you can either select the same channel, in order to alter all the axes simultaneously, or different channels, allowing you to program the axes individually).
- Move the cursor to the Factor line, where you can also change the P factor for aileron, elevator and rudder **with priority** (adjustment range up to 200%).
- Move the cursor to the D factor line, where you can alter the D factor for aileron, elevator and rudder **with priority** using a proportional control (adjustment range up to 200%; channel value -100% equates to a factor of 0%, channel value 0% equates to 100%, and +100% equates to 200%). This makes it a very easy matter to match the gyro's corrective effect to the model's airspeed. In particular, higher gyro gain can be used for the landing approach - without the need to switch flight phases.
- Now test-fly your model and fine-tune the values one by one until your preferred stabilising effect is achieved without the model oscillating.
- It may be sensible or easier to activate the gyro for one axis only at first, and then to establish the optimum setting for that axis, rather than for several axes simultaneously.

## 4.2.2. Programming, transmitter without proportional controls

GYRO SETTINGS	< >
>AILERON :	2
ELEVATOR :	4
RUDDER :	6
COEFF. :	Aus
COEFF. D :	Aus

- Move the cursor to the appropriate line, in this case "Ail" for aileron.
  - Press the SET button to activate the Channel field, select the appropriate value (1 - 10 or OFF), then press the SET button to save it.
  - First select a low value (see P factor section for starting points) and carry out a test-flight. **If gyro stabilisation is not sufficiently pronounced, increase the value step by step until the level of correction is as required; if the model already oscillates, reduce the value step by step.**
- Do not select a channel (Ch5 - Ch16); this function is only relevant to transmitters with proportional controls.
  - Move on to elevator or rudder and select the desired value (or OFF).
  - Leave the settings for "Factor" and "Factor D" at OFF.
  - It may be sensible or easier to activate the gyro for one axis only at first, and then to establish the optimum setting for that axis, rather than for several axes simultaneously.

Once you have found the optimum settings, you can set up a transmitter switch to control the gyro, i.e. for switching between gain settings. For example, you could assign a three-position switch to "Factor" and "Factor D", and then use it to switch the values between 0% (OFF), 100% and 200%.

### Flight phase specific settings

It is possible to use a channel to control the factor value by setting up **flight phase specific transmitter control settings**, but only if the transmitter is an MX20 / MC20 or MC32; please see the instructions supplied with your transmitter and refer to the "Transmitter control settings" and "Flight phase settings" menu points for more information.

### 4.3 Initialising the gyro

After switching on the model the gyroscope is immediately active but not yet initialized. To initialize it, you keep your model when switching quiet and straight in level flight - the best place is on the flat ground or a flat table. After about 2 seconds, the ailerons move up and down just once. This "wiggle" signaled the successful initialization, the end of the calibration, only then the model may be moved again.

**All sticks are to be kept strictly in neutral!**



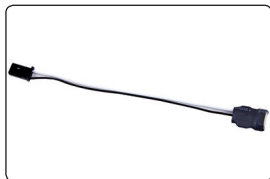
**WARNING:** during the initialisation phase the gyro detects the model's neutral attitude, and for this reason it is absolutely essential to leave the model in its 'normal flight attitude' during the activation phase, and avoid moving it! If you neglect this, the gyro may detect an incorrect flight attitude, with the result that the model will not fly as you expect it to. It may be difficult to control, and could even crash!

During the initialisation phase the receiver also detects the centre points of the individual control channels; this information is used for gyro suppression. Gyro suppression reduces the stabilising action progressively as the transmitter controls are deflected away from centre; at +/- 100% the gyro is completely disabled.

Your model is now ready to fly .. !

## 5. FIRMWARE UPDATE - GRAUPNER 33575 / 33576 / 33577 HOTT RECEIVERS

Firmware updates are loaded into the receiver via the Channel 5 output, using a PC running Windows XP, Vista or 7. You will also need the separately available USB interface, Order No. 7168.6 and the adapter lead, Order No. 7168.6A or 7168.S (33575: additional adapter lead, Order No. 33565.1). The programs and files required for this can be found in the Download area for the corresponding products at [www.graupner.de](http://www.graupner.de).



Connect the adapter lead to the USB interface, Order No. 7168.6. The connectors are polarised: note the small chamfers on one side. Never use force - the connectors should engage easily.

### 5.1 Receiver



GR-12+3xG HoTT receiver / (Order No. 33576 / 33577):  
Connect the adapter lead to receiver channel 5 as shown in the picture. The connectors are polarised: note the small chamfers on one side. Never use force - the connectors should engage easily.  
The black wire must be at the top (-), the orange wire at the bottom (T).  
GR-12SH+3xG HoTT receiver (Order No. 33575): an additional adapter lead, Order No. 33565.1 is also required.

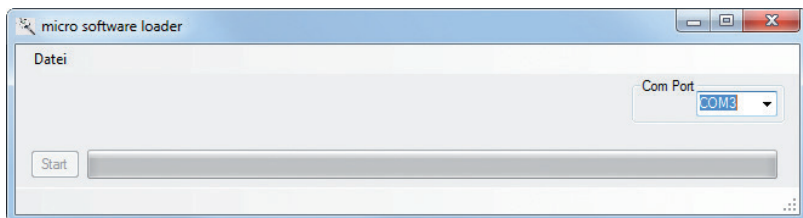
### 5.2. Update procedure

#### Start "Slowflyer/Gyro receiver update"

The "Slowflyer/Gyro receiver update" program is best called up from the "Firmware\_Upgrade\_grStudio" program. Click on the "Slowflyer/Gyro receiver update" point under "Link" in the left-hand function menu (alternatively select the appropriate entry "Micro Receiver Upgrade" under "Menu").

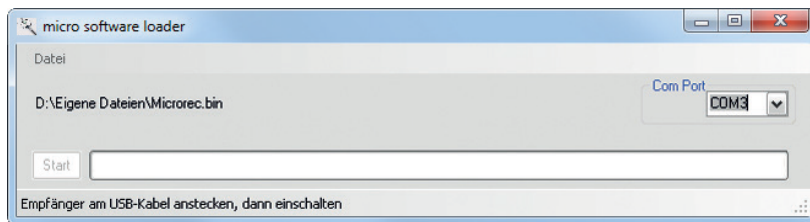
It is also possible to start the associated application program directly by double-clicking on the file "micro\_gyro\_swloader.exe". You will find this .exe file in the "Graupner\_PCSoftware" folder of the "HoTT\_Software VX" package.

A program window now appears in which you should first set the "correct" COM port for the USB interface, Order No. 7168.6, in the Select window.

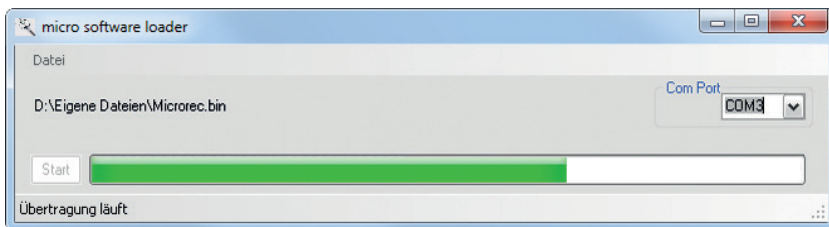


If you are not sure of this, check the COM port in the "Select Port" window in the "Controller Menu" (see above), and note down the COM port number at the "Silicon Labs CP210x USB to UART Bridge" entry – in this case "COM03" (if you select the wrong port, you will be alerted to this when you read out the receiver data). Click on xx in order to load the corresponding firmware file named "MicroStabi7X\_V\_XX.bin" from the hard disc ("XX" stands for the version number.)

When the file has loaded, click on Start ...

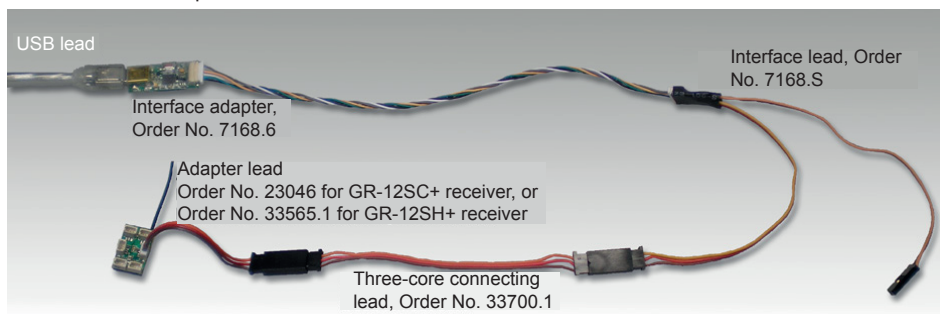


... connect the receiver, and switch it on.



The progress bar shows the transfer proceeding normally. The receiver LED is off during this period, then flashes as soon as the file transfer is complete.

Your PC may allow you to carry out a firmware update without a switch and receiver battery. In this case connect the components as shown below:



Please refer to the detailed update instructions in the Download area for the corresponding item at <http://www.graupner.de>.



**Konformitätserklärung gemäß dem Gesetz über Funkanlagen und  
Telekommunikationsendeinrichtungen (FTEG) und der Richtlinie 1999/5/EG (R&TTE)**  
Declaration of Conformity in accordance with the Radio and Telecommunications Terminal Equipment  
Act (FTEG) and Directive 1999/5/EG (R&TTE)

Graupner/SJ GmbH  
Henriettenstraße 96  
D-73230 Kirchheim/Teck

erklärt, dass das Produkt:  
declares that the product

**GR-12SH +3xG HoTT - No. 33575,  
GR-12 +3xG HoTT - No. 33576  
GR-12 +3xG + 3A + Vario HoTT - No. 33577  
GR-18 +3xG + 3A + Vario HoTT - No. 33579  
GR-24 PRO +3xG + 3A + 3M HoTT - No. 33583**

Gerätekategorie: 1  
Equipment class

den grundlegenden Anforderungen des § 3 und den übrigen einschlägigen Bestimmungen des  
FTEG (Artikel 3 der R&TTE) entspricht.  
complies with the essential requirements of § 3 and the other relevant provisions of the FTEG (Article 3 of the  
R&TTE Directive).

Angewendete harmonisierte Normen:  
Harmonised standards applied

**EN 60950-1:2006+A11:** Gesundheit und Sicherheit gemäß § 3 (1) 1. (Artikel 3 (1)a))  
**2009+A1:2010+A12:** Health and safety requirements pursuant to § 3 (1) 1. (Article 3 (1) a))  
**2011**

**EN 301 489-1 V1.9.2** Schutzanforderungen in Bezug auf elektromagnetische  
**EN 301 489-17 V2.1.1** Verträglichkeit § 3 (1) 2, Artikel 3 (1) b))  
Protection requirement concerning electromagnetic compatibility  
§ 3 (1) 2, Artikel 3 (1) b))

**EN 300 328 V1.7.1** Maßnahmen zur effizienten Nutzung des Frequenzspektrums  
§ 3 (2) (Artikel 3 (2))  
Measures for the efficient use of the radio frequency spectrum  
§ 3 (2) (Article 3 (2))



Kirchheim, 17. April 2013

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If material defects or manufacturing faults should arise in a product distributed by us in the Federal Republic of Germany and purchased by a consumer (§ 13 BGB), we, Graupner/SJ GmbH, D-73230 Kirchheim/Teck, Germany, acknowledge the obligation to correct those defects within the limitations described below.

The consumer is not entitled to exploit this manufacturer's declaration if the failure in the usability of the product is due to natural wear, use under competition conditions, incompetent or improper use (including incorrect installation) or external influences.

This manufacturer's declaration does not affect the consumer's legal or contractual rights regarding defects arising from the purchase contract between the consumer and the vendor (dealer).

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If a claim is made under guarantee, we undertake at our discretion to repair or replace the defective goods. We will not consider supplementary claims, especially for reimbursement of costs relating to the defect (e.g. installation / removal costs) and compensation for consequent damages unless they are allowed by statute. This does not affect claims based on legal regulations, especially according to product liability law.

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The purchaser is required to make the guarantee claim in writing, and must enclose original proof of purchase (e.g. invoice, receipt, delivery note) and this guarantee card. The purchaser must send the defective goods to us at his own cost, using the address stated below.

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Service Department: tel. [0049] 7021-722130**

The purchaser should state the material defect or manufacturing fault, or the symptoms of the fault, in as accurate a manner as possible, so that we can check if our guarantee obligation is applicable.

The goods are transported from the consumer to us and from us to the consumer at the risk of the consumer.

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This declaration only applies to claims made to us during the claim period as stated in this declaration. The claim period is 24 months from the date of purchase of the product by the consumer from a dealer in the Federal Republic of Germany (purchase date). If a defect arises after the end of the claim period, or if the evidence or documents required according to this declaration in order to make the claim valid are not presented until after this period, then the consumer forfeits any rights or claims from this declaration.

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If we do not acknowledge the validity of a claim based on this declaration within the claim period, all claims based on this declaration are barred by the statute of limitations after six months from the time of implementation; however, this cannot occur before the end of the claim period.

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und 12:30 -16:00 Uhr  
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GB, NEWARK, Nottinghamshire  
NG242EG  
☎ (+44) 16 36 61 05 39

**Garantie-Urkunde**

Warranty certificate / Certificat de garantie

33575 Empfänger GR12 SH +3xG HoTT  
33576 Empfänger GR-12 +3xG HoTT  
33577 Empfänger GR-12 +3xG+3A+Vario

Übergabedatum  
Date of purchase/delivery  
Date de remise

Name des Käufers  
Owner's name  
Nom de l'acheteur

Straße, Wohnort  
Complete adress  
Adresse complète

Firmenstempel und Unterschrift des Einzelhändlers  
Stamp and signature of dealer  
Cachet et signature du vendeur

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The presence of this symbol on a product, in the user instructions or the packaging, means that you must not dispose of that item, or the electronic components contained within it, in the ordinary domestic waste when the product comes to the end of its useful life.

The correct method of disposal is to take it to your local collection point for recycling electrical and electronic equipment.

Individual markings indicate which materials can be recycled and re-used. You can make an important contribution to the protection of our shared environment by re-using the product, recycling the basic materials or re-processing redundant equipment in other ways.

Dry cells and rechargeable batteries must be removed from the device and taken separately to a suitable battery disposal centre.

In the case of RC models electronic components such as servos, receiver or speed controller must be removed from the product, and taken separately to the appropriate collection point for electrical waste.

If you don't know the location of your nearest disposal centre, please enquire at your local council office.



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Germany  
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Mai 2013 - DE V1.0